

# Feral Hog Management Plan



**Sequoiah National Wildlife Refuge**  
United States Department of Interior  
Fish and Wildlife Service  
Region 2

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**FERAL HOG MANAGEMENT PLAN**

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# I. INTRODUCTION

## 1.1 Area Description

The Sequoyah National Wildlife Refuge (SNWR or Refuge) is an overlay project of the U.S. Army Corps of Engineers (USACE) established on the 42,000 acre Robert S. Kerr Reservoir by Cooperative Agreement No. DACW56-3-71 on December 11, 1970, to “...*be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon...*” 16 U.S.C. 664 (Fish and Wildlife Coordination Act). Migratory waterfowl are the main management thrust of the Refuge. Wading birds, shorebirds, white-tailed deer, other resident wildlife species thrive on the Refuge as well.

Strategically situated at the confluence of the Canadian and Arkansas Rivers, the Refuge is a valuable sanctuary containing rich river-bottomland forests with numerous ponds and sloughs that provide food and cover for migratory and resident wildlife species. The distinct landscape, diversity of biological communities, and secluded location are inherent characteristics that contribute to the area’s value as a natural preserve. The Refuge provides a variety of protected habitats for wildlife, open space and nature-oriented recreational activities for the public.

This eastern section of Oklahoma has historically been a prime waterfowl migration and use area. The Arkansas River and surrounding lands provided ample water, food, and habitat that attracted thousands of migrating waterfowl each year. Today, the Refuge continues to offer sanctuary to migratory waterfowl in the fall, winter and spring. The value of these lands that were set aside and dedicated to providing waterfowl habitat also benefit other migratory bird species and resident wildlife species throughout the year. The Refuge’s land and water restoration activities are designed and implemented to improve waterfowl habitat, and to benefit more than 272 species of birds, 46 species of mammals, 94 species of reptiles and amphibians, and 73 species of fish. While the primary challenges on the Refuge have centered on conservation and management of habitat for migrating birds and other native wildlife species, the Refuge also conserves and manages habitat for federally listed threatened and endangered species, and several species of concern, including the American burying beetle and interior least tern

Located in the heart of a rural community, the Refuge receives increasing influences from the nearby urban areas of Muskogee, Tulsa and Oklahoma City to the west and Ft. Smith and Little Rock to the east. The Refuge was established on the upper end of the Robert S. Kerr Reservoir in eastern Oklahoma and overlaps the junction of Sequoyah, Muskogee and Haskell counties. The Refuge headquarters is located 3 miles south of the Vian exit on Interstate 40 (I-40), 35 miles west of Fort Smith, Arkansas, and approximately 150 miles east of Oklahoma City, Oklahoma. Other refuges in proximity to the Refuge include Ozark Plateau NWR, approximately 45 miles to the north, Deep Fork NWR, approximately 70 miles to the west, and Little River NWR, approximately 120 miles to the south.

The target area for this Feral Hog Management Plan is the entire Refuge (Figure 1). Feral hog populations will have to be managed continuously for many reasons: (1) there is no way to restrict passage of any wildlife from entering or leaving the Refuge; (2) sows breed prolifically; and (3) the state of Oklahoma does prevent the public from feeding feral hogs.

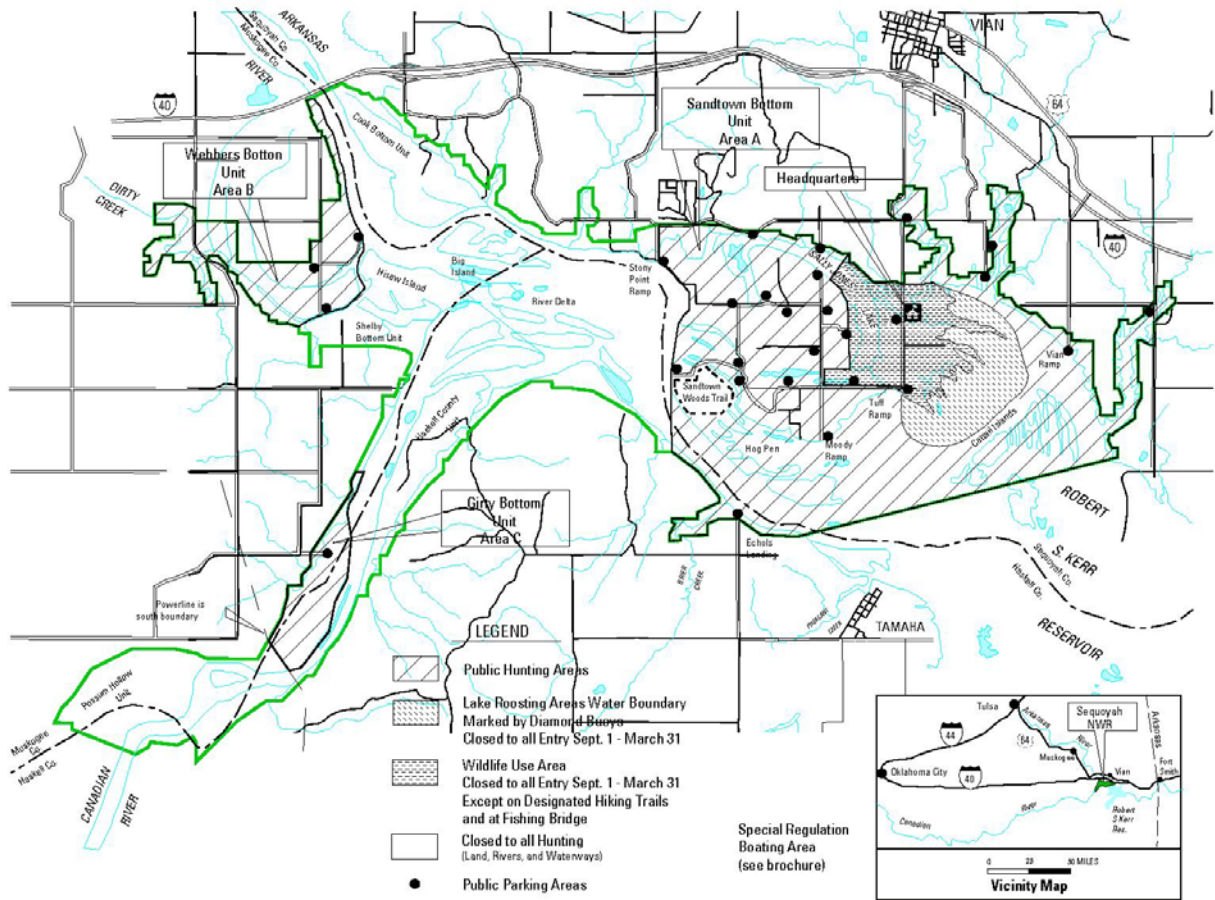


Figure 1. Map of Sequoyah National Wildlife Refuge

## **1.2 Land Use**

Before the establishment of Sequoyah National Wildlife Refuge, the land encompassed within Sequoyah County consisted of several thousand acres of large level bottomland/agricultural complexes. The existing habitat also contained large, shallow wetland areas where suitable farming practices could not occur. The Muskogee County acreage, consisted of approximately 10,000 acres, and was located at the upper end of the reservoir. The area is comprised of a large, level bottom of agricultural land that would be well adapted to the creation of wetlands (USFWS 1962). Prior to the alteration of the native river ecosystems by the United States Army Corps of Engineers, many small islands and oxbows located along these river sections existed. In addition, numerous, large sandy flats lined the river corridors along the Arkansas and Canadian river corridors that were highly utilized by shore birds and waterfowl.

Since the refuge's establishment in 1970, there is now an active cooperative farming program (7-10 cooperators) in which approximately 2800 acres are planted annually. The program supplements natural foods with grain foods, such as corn, milo, seeded millets and green browse. Farming is an integral part of the Refuge's habitat management program, providing food, browse, cover and resting areas for migratory birds and other resident wildlife. Cooperative farming has been used for more than 38 years to meet these goals on the Refuge. Currently, the Refuge share consists of one or more of the following crops: corn, millet, and winter wheat, which are left standing after the cooperative farmers' harvest.

It has also been determined that the following public uses are compatible with the purpose for which the Refuge was established: hunting, fishing, wildlife observation/wildlife photography, environmental education and interpretation, auto touring, commercial photography, jogging/running/bicycling, motorized boating, and natural resource collecting (firewood, berries, nuts and mushrooms). The Refuge allows the use of non-motorized watercraft for quiet access to small-water and/or shallow-water areas for fishing activities. Walking/jogging activities are allowed on established public use roads and trails. Both of these activities have little to no impact on the resource.

## **1.3 Background Summary**

Little is known about the introduction of feral hogs on Sequoyah NWR. The current number of hogs now on the Refuge is unknown due to hogs' ability to potentially double their population in four months when given adequate food resources, hiding cover, and unlimited area to roam due to the inaccessibility of tracts managed by Sequoyah NWR. Evidence of hogs, such as rooting, feces, trails, and tracks have recently been seen along roadways and in agricultural fields. Most alarmingly, is the field damage due to rooting that is occurring throughout cooperative farming tracts in Muskogee County.

## **1.4 Past Feral Hog Management Strategies**

The Refuge has implemented minimal feral hog management techniques (trapping) historically. This plan is the first collaborated and funded effort to initiate feral hog control measures.

## **1.5 Purpose and Need**

Feral hogs are exotic and a nuisance species that have been hindering management practices on the Refuge and adjacent private properties. The practices discussed in this document are directed toward the conservation of wildlife resources to assure the preservation of native plants and animals. Of utmost concern is the constant threat feral hogs pose to the bottomland hardwood ecosystem, public safety, and agricultural operations on the Refuge and adjacent private lands. Feral hogs have been inflicting damage

to waterfowl food production. In addition, they compete with native wildlife for food mast as well as cause disturbance to soils allowing for the invasion of exotic plant species. Feral hogs also serve as disease reservoirs and pose a threat to the health of both humans and other animals. They are known to carry 13 diseases, including brucellosis, pseudo rabies, tuberculosis, bubonic plague and anthrax (Burns and Loven 1998). Feral hogs are also known to occasionally charge humans, with possibly fatal consequences. Finally, feral hogs also interfere with agricultural operations and may create obstructions to farm equipment and loss of agricultural products when the animals perform rooting behaviors. The development and implementation of an effective and humane plan to remove this exotic pest is essential to achieving the Service's goal of conserving and preserving native wildlife.

The goal of this Feral Hog Management Plan is to control the expanding population of feral hogs (*Sus scrofa*) and reduce their numbers on Sequoyah National Wildlife Refuge. Controlling and reducing the feral hog population on the Refuge would reduce competition between feral hogs and native wildlife, reduce habitat disturbance and reduce plant loss caused by hog activity.

The Refuge proposes to increase removal of hogs by initiating one or more of the following control means: (1) Provide for inter-agency trapping on designated refuge areas and (2) provide for the use of in-house U.S. Fish & Wildlife Service trapping on designated areas of the refuge.

## **II. BIOLOGICAL CHARACTERISTICS**

### **2.1 Description**

Feral hogs are wild swine from domestic ancestry. Native to Eurasia, feral hogs should not be confused with the collard peccary (javelina) of the Southwest. They were first introduced to the U.S. in 1539, when Spanish explorer Hernando de Soto brought them to Florida. After that, it was common practice for settlers to allow their domestic swine to roam freely. Many years later, sport hunters introduced true Eurasian wild boars into certain areas of the U.S., and their bloodlines have become mixed with those of the wild pig (USDA 2005). The feral swine population that exists today is a combination of domestic, escaped, or neglected domestic swine, Eurasian wild boar or feral pigs that have been captured for the purpose of starting wild, free-living populations.

### **2.2 Distribution of feral hogs at Sequoyah National Wildlife Refuge**

Feral hog populations have been found on every tract of land in SNWR with the exception of refuge property on the north side of the Arkansas River. There are no fencing or natural barriers to prevent hogs from wandering into property. Furthermore, the adjacent private lands may or may conduct feral hog management techniques.

### **2.3 Reproduction**

Feral hogs are the most prolific large mammal in North America and given adequate nutrition, can double their population in four months (Barrett and Birmingham 1994). Sows normally begin breeding at six months of age and have an average of two litters per year with 4-10 offspring per litter (Stevens 1996). Here at Sequoyah NWR, the feral hog breeding season is year-long as sows with their offspring are observed year round.

## **2.4     *Home Range and Activity Period***

Feral hog home ranges can vary from 0.4-19 square miles depending on availability of food and water (Stevens 1996). Males have larger home ranges than females, especially during the breeding season (Stevens 1996). Unless accompanied by a receptive sow, boars are generally solitary when traveling and feeding. Groups of hogs normally seen throughout the Refuge consist of sows and their offspring.

## **2.5     *Habitat***

Feral hogs have demonstrated that they can adapt to just about any habitat type and are reported to have established populations in at least 27 states across the US (Rachel Maderik, pers. comm, National Invasives Species Center, 2006). They seem to prefer moist bottomland, and are probably most common along riparian areas with dense vegetation (Stevens 1996). Feral hogs at the Sequoyah NWR are most commonly observed feeding in the emergent vegetation surrounding the marsh and within agricultural fields, traversing along their extensive network of trails.

Feral hogs can grow to be rather large. Adult hogs do not seem to have any natural predators other than humans. Smaller offspring may be taken by coyotes and bobcats, however, this predation is countered by large litter sizes and does not seem to have an effect on hog populations.

## **2.6     *Food Habits/ Competition***

Feral hogs are opportunistic omnivores (Stevens 1996). Along with a diet high in vegetative matter, portions of birds, eggs, small mammals, fawns, frogs, snakes, lizards, salamanders, turtles, and insects have all been found in feral hog stomachs along with a large number of invertebrates (Wood and Barrett 1979). With their keen sense of smell, feral hogs are formidable predators. Calves, goat kids, lambs, fawns, and ground nesting birds have been known to become prey of feral hogs (Stevens 1996). Although the feral hogs at Sequoyah NWR are no different, the season or time of year determines the bulk of their diet. Of concern is the documentation of potential competition for food with deer, turkey, waterfowl, squirrels, raccoons, opossums, foxes, bobcats, javelinas, bears, sandhill cranes, coyotes and chipmunks (Stevens 1996). Although several of these species are not present at Sequoyah NWR, this list was provided to emphasize the diverse diet of feral hogs, and the extent in the number of species affected by their presence.

## **2.7     *Damage and Environmental Concern***

Feral hogs spend considerable time rooting and wallowing. Rooting is a common activity done year round in search of food. Rooted areas can be very large, sometimes covering entire fields. In softer soils, rooting can reach a depth of three feet (Samuel Roberts Noble Foundation 2006). This behavior contributes to soil erosion, reduces water quality and damages agricultural crops and hay fields. It also destroys sensitive natural areas. Feral hogs have a keen sense of smell and are opportunistic feeders (MDC 2007a). These destructive animals are known to tear through livestock and game fences and consume animal feed, minerals and protein supplements. Not only do they feast on field crops such as corn, milo, rice, watermelon, peanuts, hay, turf and wheat, but are also efficient predators and when given the opportunity, will prey upon young livestock and other small animals (USDA 2005). Calves, kids, lambs, fawns and ground nesting birds have been known to become prey of feral hogs (Samuel Roberts Noble Foundation 2006). Feral hogs also transmit and are reservoirs for serious human and livestock diseases, including brucellosis, pseudobrucellosis and trichinosis (Davis 1998).



## 2.8 *Disease*

Feral hogs serve as disease reservoirs (Miller 1993) and pose a threat to the health of both humans and other animals. They are known to carry 13 diseases, including brucellosis, pseudo rabies, tuberculosis, bubonic plague and anthrax (Burns and Loven 1998). The two diseases of most concern are pseudo rabies and swine brucellosis.

Pseudo rabies is not related to the rabies virus and cannot infect humans (Stevens 1996). It is a viral disease and affects the nervous system. It can be transmitted and carried by both domestic and feral hogs and can be fatal to cattle, horses, goats, sheep, dogs, cats, raccoons, skunk, opossum and small rodents. Once hogs become infected they are carriers for life.

Swine brucellosis causes infertility and is transmitted through reproductive discharges such as semen or afterbirth (Stevens 1996). To date, the only method of control involves testing and removal of infected individuals in the population, a method not feasible in wild populations. This disease could be transmitted to humans, and can be expressed by flu-like symptoms, arthritis, and meningitis. Humans can be treated with antibiotics, but there is no cure for other animals.

### III. **AUTHORITY FOR ACTION**

#### **Refuge Manual (7RM 14) – Pest Control**

(14.2) The policy of the U.S. Fish & Wildlife Service is to engage in the necessary control of wildlife within the National Wildlife Refuge System to assure balance of wildlife and fish populations consistent with the optimum management of refuge habitat.

(14.9 b) Control of trespass and feral animals and other animal control operations.

#### **Title 50 CFR Part 30, Section 11 – Control of feral animals.**

Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized Federal or State personnel or by private persons operating under permit in accordance with applicable provisions of Federal or State law or regulations.

#### **Title 50 CFR Part 31, Section 14 – Official animal control operations.**

(a) Animal species which are surplus or detrimental to the management program of a wildlife refuge area may be taken in accordance with Federal and State laws and regulations by Federal or State personnel or by permit issued to private individuals.

(b) Animal species which are damaging or destroying Federal property within a wildlife refuge area may be taken or destroyed by Federal personnel.

In the state of Oklahoma feral hogs are considered exotic. Officially, they are classified as a non-game, non-protected species. As such, there are no formal hunting seasons and feral hogs can be taken by whatever means. Their non-game status exempts them from the laws concerning animal waste.

## **IV. MANAGEMENT GOALS**

Employing an effective control method is essential to accomplishing the goal of eradication or drastic reduction in feral hog numbers (USFWS 1996). As previously stated, feral hogs are the most prolific large mammal in North America and given adequate nutrition, a feral hog population can double in four months (Barrett and Birmingham 1994). For a control method to be successful 70 percent of the population must be removed annually in order to exceed recruitment within the herd and affect control within 9 years; 70 percent must be removed twice a year to affect control in three years (USFWS 1996).

## **V. MANAGEMENT OPTIONS**

Current research has demonstrated that effective control of feral hog populations is possible, but requires a combination of lethal control measures. Aerial hunting with helicopters, cage traps, foot and neck snares, and hunting with hounds are the most effective control measures when used in combination. However, not all of these methods are considered appropriate to Sequoyah NWR. The selected control method for a particular habitat type depends on the (1) hog population density, (2) terrain and vegetation, (3) distance from Refuge or private infrastructure, (4) available access roads and (5) proximity to human population centers. To evaluate each control method, a number of questions must be asked. Is the method:

1. Effective in removing a large number of hogs in a short amount of time with minimal effort;
2. Reasonable from a cost-benefit standpoint;
3. Relatively humane, recognizing that any technique involves some measure of trauma, pain and suffering to the animal sought;
4. Safe to humans who employ it and non-impacting on non-target animals and the habitat; and
5. Legal and in compliance with Federal, State and County laws, rules, regulations, policies and standards. (USFWS 1996)

### ***5.1 Inter-agency and Refuge Personnel Trapping Program***

Currently the Refuge has various box and corral style live traps to be used with corn as bait. The Refuge staff would like to capture large numbers of feral hog at once to increase efficiency and minimize costs. The Refuge is composed of large tracts of land spread across three counties with great distances between them. Refuge staff recognizes the trapping techniques would ensure that only target animals are taken and disposed of in a humane manner.

Refuge staff management is advantageous in that staff already has knowledge of all tracts, know where the damage is occurring, and are not required to have permits. Portable cage traps can be placed in areas of recent hog activity, but their small size limits the number of hogs that can be caught. Corral traps are much larger and are designed to catch large numbers of feral hogs. Since they are semi-permanent, they must be placed in areas of repeated hog activity. Refuge employees keep records as to the age class, sex, and number of target species taken. Records of non-target species captured are also kept.

Opportunistic take by authorized government employees is another technique currently used by specific Refuge employees. This technique is used when authorized government employees happen to walk upon a hog and can take the animal in an easy and safe manner. This method is inexpensive, humane, and does not require much time. However, it is only opportunistic and will not remove large amounts of feral hogs.

### **5.2 Wildlife Damage Management Personnel (USDA/ODWC) (Interagency Contract)**

Wildlife damage management specialists are available for use on the refuge. These specialists are state and federal government employees that provide their own traps and are highly skilled and knowledgeable in methods of disposing problem animals. These individuals are ideal to run a pest management program, however, they are responsible for entire counties and would not be able to devote enough time specifically to the Refuge to manage the entire program. This person's professional opinion will be used in conjunction with other methods for a hog management program or in emergency situations where other actions may take too long to implement. This wildlife damage management specialist must also keep records as to the age class, sex, and number of target species taken. Records of non-target species captured must also be reported.

## **VI. MONITORING**

Monitoring the number of feral hogs, their distribution and impacts on the habitats of native plants and animals should become an integral part of the Feral Hog Management Plan. Measuring hog activity levels on the Refuge is necessary for evaluating the damage caused to the habitat and the success of control methods (USFWS 1996).

Engeman et al. (2001) has developed several protocols for feral hog monitoring. Due to time constraints and other on-going projects, the simplest methods have been chosen for feral hog monitoring.

### **Damage Monitoring:**

Parallel transects (100 m), spaced 200 m apart, will be used to check for hog damage. The 100 m tape will be laid out and walked. Any activity (tracks, fecal matter, rooting) seen while walking the transect will be counted and ranked pre-trapping, 6 months into the trapping and at the end of the trapping phase. Contingency tables will be used to compare the different phases of management and assess whether less damage is occurring as trapping progresses. One year after trapping has ceased, the tracts will be monitored again to assess whether trapping needs to take place again.

### **Activity Monitoring:**

SNWR is a bottomland hardwood area that is prone to flooding and usually has a dense layer of leaf litter on the ground. This makes density estimates difficult to acquire. However, most roads in SNWR are unpaved and take tracks easily as the ground is soft after it rains. Hogs are known to use roads for traveling in Refuge property. To monitor hog population trends the roads could be used as transects. The muddy roads could be resurfaced using an ATV. The next day an observer would be able to visit the resurfaced road and count new hog tracks found. A decline in track sets would be expected. However, this will not work for all tracts on SNWR as some tracts have well-vegetated roads. This will be tried in suitable tracts pre-trapping, 6 months into the trapping program, and post-trapping phase. A large decline

in the number of tracks found (>50%) would be expected. These monitoring options will not require the Refuge to purchase any extra equipment and can easily be carried out by one person. Only simple statistics will be required to test data.

## **VII. FUTURE REVISIONS**

As new research, technologies, and techniques become available, they may be incorporated into the existing management plan in the form of amendments.

## **VIII. PROGRAM ADMINISTRATION**

Free-ranging hogs are considered feral animals by the U.S. Fish and Wildlife Service and may be destroyed by authorized Refuge personnel at any time. The Refuge Manager will determine changes to or updates within this plan. The Refuge Manager's word will be final in any disagreement.

All official correspondence regarding the contract should be sent to the following address:

**U.S. Fish and Wildlife Service  
Sequoyah NWR  
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